

THE FLORA OF PERU: A CONSPECTUS

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The *Flora of Peru* is the only floristic treatment of Andean or upper Amazonian plants and is one of the most significant of all floristic works. Except for the monumental 19th century *Flora Brasiliensis*, the *Flora of Peru* is today the closest thing to a complete Flora enjoyed by any South American country. The present volume marks the re-inauguration of this project after a hiatus in publication of almost a decade. We anticipate that the *Flora of Peru* will be completed in 1986.

The *Flora of Peru* was begun in 1936 under the direction of J. Francis Macbride who had been hired by Field Museum in 1922 specifically to study Peruvian plants. Macbride and associates made several plant-collecting expeditions to Peru in the 1920's, and other collections of Peruvian plants were also accumulated by Field Museum during this time. By 1936 when the first volume of the *Flora of Peru* was published, Dahlgren (1936) estimated that Field Museum collections included over 33,000 sheets of Peruvian plants which were "undoubtedly the most complete representation of the flora of that country in existence." Although this data base seems quite comparable to that on which initial publications of other Latin American Floras now nearing completion—the largely concurrent Floras of Panama and Guatemala—were undertaken, it was hopelessly inadequate for Amazonian Peru and far from complete for large areas of the Peruvian uplands and many of the coastal lomas as well. As a result the *Flora of Peru* shares with these other attempts to document the incredibly rich neotropical flora many faults attributable to an inadequate collection base (Gentry, 1978).

Another problem with which Macbride was forced to cope, in an era when transoceanic loans of specimens were not so readily available as today, were many species described from Peru but inadequately known

to him. His solution was generally to accept essentially all species which had been proposed: "It soon became evident that an attempt to express an opinion on the merit or lack of merit of every species proposed was impractical if the whole work was to be completed within a reasonable period" (Macbride, 1936). Though perhaps inevitable in the context of 1936, this lack of a thoroughgoing attempt to critically evaluate the species accepted in the Flora poses problems for its users today.

Despite the criticisms to which the perspective of half a century can lead, Macbride's compilation of the *Flora of Peru* is universally recognized as having been a truly herculean task. Macbride's own contributions to the Flora spanned a quarter century from 1936 until 1962, and several subsequent specialists' contributions swelled the number of species published in the Flora to 11,789 (plus an additional 246 varieties) at the cessation of its active publication in 1971.

Although contributing specialists were used when available, the great majority of the compilation of Peruvian plants was by Macbride himself. Paul Standley contributed 10 familial treatments, including the large ones for Gramineae and Rubiaceae. Ellsworth Killip contributed the treatments of Passifloraceae, Caprifoliaceae, Valerianaceae, Urticaceae, and the genus *Bomarea*. Charles Baehni contributed three familial treatments: Lacistemaceae, Violaceae, and Sapotaceae, the latter two co-authored with associates. Lyman Smith contributed treatments of Bromeliaceae and Begoniaceae, the latter jointly authored with B. Schubert, and J. Steyermark treated Fumariaceae and Connaraceae. Fifteen other taxonomists contributed treatments of families or important genera to the Flora, including Schweinfurth's monumental Orchidaceae work and treatments of Piperaceae by Trelease, *Rumex* by Rechinger, Annonaceae by R. Fries, Myristicaceae by A. C. Smith, *Krameria* by Hartmann, *Monnina* by R. Ferreyra, Callitrichaceae by N. Fassett, Myrtaceae by R. McVaugh, Umbelliferae by M. Mathias and L. Constance, Hydrophyllaceae and Polemoniaceae by D. Gibson, *Solanum* by D. Correll, Scrophulariaceae by G. Edwin, Plantaginaceae by R. Pilger, and Campanulaceae by F. Wimmer. Some of these are still considered among the definitive taxonomic works on major plant groups. Altogether 32 families and an additional five genera were treated by specialists and 84 families were treated by Macbride.

In 1975 the *Flora of Peru* was revitalized as a joint project of Field Museum and the Missouri Botanical Garden under this author's direction and supported by the National Science Foundation. An additional 15 spermatophyte families remain to be treated, including the Com-

positae, the largest family of the Peruvian flora, which has been subdivided into tribes to be published individually. Specialists' treatments of all the remaining families and the tribes of Compositae have been arranged, with the last promised by 1986.

Pteridophytes were not included in the original *Flora of Peru* but Rolla Tryon (1964) has separately published an account of an estimated quarter (187 species) of the Peruvian ferns using a somewhat more elaborate format than Macbride's. The remainder of the Peruvian pteridophytes will also be treated under the reactivated *Flora of Peru*, although arrangements for specialist contributions of only part of the pteridophytes have been completed to date.

At this point a preliminary analysis of the Peruvian flora and the completeness of its coverage by the published Flora seems appropriate. To the 11,789 species of spermatophytes treated to date can be added 2,148 additional species, the sum of the estimates of numbers of species in their groups by the various contributors, to give a total number of 13,937 species expected to have been treated in the *Flora of Peru* when it is completed. Similarly 1,654 genera of spermatophytes have already been treated and 298 remain to be covered, for a total of 1,952 genera to be included in the Flora. Table 1 lists the largest families and genera in Peru, as treated in the Flora. It is noteworthy that the number of species included is nearly double that included in the *Flora of Guatemala* and approaching triple the number of species included in the *Flora of Panama* (see Gentry, 1978), a striking indication of the immensity of the task undertaken by Macbride. Only the 19th century *Flora Brasiliensis* covers a larger portion of the neotropical flora.

It is obvious that a neotropical Flora whose publication was begun in 1936 is likely to omit many species which actually occur in the country. For example the *Flora of Panama* will treat only 5,000 of the 8,000-9,000 species estimated to actually occur in that country (Gentry, 1978). In Peru coverage of the floristically rich Amazonian region is especially incomplete, suggesting that many more than the 14,000 species treated in the Flora may actually occur in Peru.

On the other hand, many of the published treatments in the *Flora of Peru* were prone to excessive taxonomic splitting. For example, the genus *Peperomia* was treated as including 342 species and varieties in Peru; the fact that 78% of the accepted taxa were based on single collections and 90% on two or fewer collections is highly suggestive of unwarranted splitting. An average of 1.59 collections per accepted taxon could hardly be adequate for understanding intraspecific varia-

TABLE 1. Largest families in *Flora of Peru*.

Family	No. of species
Compositae	1,432*
Orchidaceae	1,290 (+38 var.)
Leguminosae	751 (+7 var.)
Piperaceae	726 (+64 var.)
Melastomataceae	509
Rubiaceae	480
Gramineae	408
Solanaceae	401 (+29 var.)
Euphorbiaceae	269
Scrophulariaceae	229 (+12 var.)
Malvaceae	218
Campanulaceae	192 (+42 var.)
Myrtaceae	178 (+6 var.)
Bromeliaceae	175
Verbenaceae	174 (+2 var.)
Labiatae	173
Araceae	165
Cyperaceae	156 (+3 var.)
Gesneriaceae	155*
Gentianaceae	150
Guttiferae	150*
Cactaceae	150*

*Estimated.

TABLE 2. Comparison of species numbers in *Flora of Peru* and Peruvian species in *Flora Neotropica* monographs.

Taxon	No. of genera		No. of species (+var.)	
	Fl. of Peru	Fl. Neotr.	Fl. of Peru	Fl. Neotr.
Swartzia	1	1	11	13(+1)
Brunelliaceae	1	1	8	8
Moraceae (Olmedieae and Brosimeae)	9	9	29	30(+2)
Zingiberaceae	4	4	37	29(+3)
Chrysobalanaceae	4	4	29	36(+1)
Dichapetalaceae	4	3	15	14(+1)
Caryocaraceae	2	2	8	6
Manihot	1	1	6	5
Bromeliaceae (Pitcairnioideae and Tillandsioideae)	8	8	148	270(+13)
Memecyleae	1	1	9	11
Trigoniaceae	1	1	7	6
Bignoniaceae	44	41	106	125
Totals	80	76	413	553

tion in *Peperomia*. Uncritical treatments of other groups similarly led to inclusion of some variable species under several different names, inflating the number of Peruvian species.

Is it possible to reconcile these two opposing trends and arrive at a meaningful estimate of the actual number of species in the Peruvian flora without critically reworking the entire Flora? One feasible approach is to compare the number of species "lost" and "gained" from the Flora when compared with that in recent monographs of plant groups occurring in Peru. I have used the *Flora Neotropica* monograph series to arrive at such an estimate. My own specialty group Bignoniaceae is also included, since I have the data readily available, even though only part of the family has been monographed to date for *Flora Neotropica*. Table 2 compares the number of species and genera recorded from Peru in each of the relevant *Flora Neotropica* treatments with the number treated in the Flora. The total of 413 species treated in the *Flora of Peru* for these 12 groups increased to 553 species in the *Flora Neotropica* monographs, a 34% average increase. Although acknowledging that 413 species is a perilously small (3%) sample of the total *Flora of Peru* species, we may tentatively extrapolate from these figures an average increase of 34% in number of species now known from Peru as compared with the number included in the Flora. Applied to the 13,937 treated species, this would project to 18,676 Peruvian plant species.

Actually the Peruvian flora might be expected to be significantly richer than this since very few of the 15,000 collections generated by the current *Flora of Peru* project have been included in the *Flora Neotropica* treatments on which these estimates were based. Many new and new-to-Peru species have already been discovered in some of these groups subsequent to the *Flora Neotropica* monographs. Moreover the rate of discovery of new species in these groups shows no signs of leveling off. Thus it seems likely that a definitive tabulation of Peruvian plants would eventually be expected to include well over 20,000 species, approximately as many plant species as are included in such very much larger areas as North America or tropical continental Africa (cf. Raven, 1976). Thanks to its Flora, Peru is the only tropical South American country (except tiny Surinam) for which such a figure, useful however tentative, can somewhat meaningfully be extrapolated.

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- TRYON, R. 1964. The ferns of Peru: Polypodiaceae (Dennstaedtieae to Oleandreae). *Contr. Gray Herb.* **194**, pp. 1-253.

INDEX TO PUBLISHED FAMILIES

Family	Publication Data
Acanthaceae (Wasshausen)	_____
Actinidiaceae	3A(2): 677-686. 1956.
Aizoaceae	2(2): 558-562. 1937.
Alismataceae	1(1): 91-94. 1936.
Amaranthaceae (Standley)	2(2): 478-518. 1937.
Supplement	2(3): 1134-1136. 1938.
Amaryllidaceae (<i>Bomarea</i> by Killip)	1(3): 631-690. 1936.
Anacardiaceae	3A(1): 238-258. 1951.
Annonaceae (Fries)	2(3): 700-766. 1938.
Apocynaceae	5(1): 363-455. 1959.
Aquifoliaceae	3A(1): 270-288. 1951.
Araceae	1(3): 428-486. 1936.
Araliaceae	5(1): 8-44. 1959.
Aristolochiaceae	2(2): 431-443. 1937.
Asclepiadaceae (Spellman & Morillo)	_____
Balanophoraceae	2(2): 427-431. 1937.
Balsaminaceae (Gentry)	_____
Basellaceae	2(2): 573-578. 1937.
Bataceae	2(2): 546. 1937.
Begoniaceae (L. Smith & B. Schubert)	4(1): 181-202. 1941.
Berberidaceae	2(3): 665-680. 1938.

Family	Publication Data
Betulaceae	2(2): 267-268. 1937.
Bignoniaceae	5C(1): 3-101. 1961.
Bixaceae	(as Flacourtiaceae)
Bombacaceae	3A(2): 593-622. 1956.
Boraginaceae	5(2): 539-609. 1960.
Bromeliaceae (L. Smith)	1(3): 495-592. 1936.
Brunelliaceae	(as Cunoniaceae)
Burmanniaceae	1(3): 767-768. 1936.
Burseraceae	3(2): 703-717. 1949.
Butomaceae	1(1): 94-95. 1936.
Buxaceae	3A(1): 220-221. 1951.
Cactacea (Solomon)	_____
Callitrichaceae (Fassett)	3A(1): 235-237. 1951.
Calyceraceae	6(2): 489-491. 1937.
Campanulaceae (Wimmer)	6(2): 383-489. 1937.
Cannaceae	1(3): 738-741. 1936.
Capparaceae	2(3): 984-1006. 1938.
Caprifoliaceae (Killip)	6(2): 281-287. 1937.
Caricaceae	4(1): 132-143. 1941.
Caryocaraceae	3A(2): 697-703. 1956.
Caryophyllaceae	2(2): 578-638. 1937.
Celastraceae	3A(1): 259-270. 1951.
Ceratophyllaceae (Gentry)	_____
Chenopodiaceae (Standley)	2(2): 469-478. 1937.
Chloranthaceae	2(2): 257-260. 1937.
Clethraceae	5(1): 45-50. 1959.
Cochlospermaceae	(as Flacourtiaceae)
Columelliaceae	5C(1): 101-103. 1961.
Combretaceae	4(1): 221-229. 1941.
Commelinaceae	1(3): 592-608. 1936.
Compositae (Dillon, Jones, King, Holmes, McDaniel, Turner, Robinson, Sagastegui, Keil, Barkley, Ferreyra)	_____
Connaraceae (Steyermark)	2(3): 1119-1125. 1938.
Convolvulaceae	5(1): 455-536. 1959.
Coriariaceae	3A(1): 237-238. 1951.
Cornaceae	5(1): 44-45. 1959.
Crassulaceae	2(3): 1007-1015. 1938.

Family	Publication Data
Cruciferae	2(3): 937-983. 1938.
Cucurbitaceae	6(2): 321-383. 1937.
Cunoniaceae	2(3): 1038-1063. 1938.
Cycadaceae	1(1): 81-82. 1936.
Cyclanthaceae (Standley)	1(3): 421-428. 1936.
Cyperaceae	1(1): 261-320. 1936.
Dichapetalaceae	3(3): 954-964. 1950.
Dilleniaceae	3A(2): 667-677. 1956.
Dioscoreaceae	1(3): 690-707. 1936.
Dipsacaceae	_____
Ebenaceae	5(1): 205-214. 1959.
Elaeocarpaceae	(as Tiliaceae)
Elatinaceae	1(1): 84-86. 1936.
Ephedraceae	1(1): 84-86. 1936.
Ericaceae	5(1): 50-149. 1959.
Eriocaulaceae	1(3): 489-494. 1936.
Erythroxylaceae	3(2): 632-647. 1949.
Euphorbiaceae	3A(1): 3-200. 1951.
Flacourtiaceae	4(1): 5-52. 1941.
Frankeniaceae	4(1): 4-5. 1941.
Fumariaceae (Steyermark)	2(3): 936-937. 1938.
Gentianaceae	5(1): 270-363. 1959.
Geraniaceae	3(2): 511-544. 1949.
Gesneriaceae (Skog)	_____
Gnetaceae	1(1): 86. 1936.
Gramineae (Standley)	1(1): 96-261. 1936.
Guttiferae (Maguire)	_____
Haemodoraceae	1(3): 630-631. 1936.
Haloragaceae	5(1): 3-8. 1959.
Hernandiaceae	2(3): 931-933. 1938.
Hippocrateaceae	3A(1): 200-220. 1951.
Humiriaceae	(as Linaceae)
Hydrocharitaceae	1(1): 95-96. 1936.
Hydrophyllaceae (Gibson)	5A(2): 101-112. 1967.
Hypericaceae (Robson)	_____
Icacinaceae	3A(1): 221-233. 1951.
Iridaceae	1(3): 707-717. 1936.
Juglandaceae	2(2): 263-266. 1937.
Julianaceae	2(2): 266-267. 1937.
Juncaceae	1(3): 609-617. 1936.
Labiatae	5(2): 721-829. 1960.

Family	Publication Data
Lacistemataceae (Baehni)	4(1): 52-56. 1941.
Lauraceae	2(3): 819-931. 1938.
Lecythidaceae	4(1): 229-249. 1941.
Leguminosae (<i>Krameria</i> by Hartmann)	3(1): 3-507. 1943.
Lemnaceae	1(3): 486-487. 1936.
Lentibulariaceae (Taylor)	_____
Liliaceae	1(3): 617-630. 1936.
Linaceae	3(2): 621-632. 1949.
Loasaceae	4(1): 143-181. 1941.
Loganiaceae	5(1): 239-269. 1959.
Loranthaceae	2(2): 375-416. 1937.
Lythraceae	4(1): 206-219. 1941.
Magnoliaceae (Lozano)	_____
Malesherbiaceae	4(1): 85-90. 1941.
Malpighiaceae	3(3): 781-871. 1950.
Malvaceae	3A(2): 442-593. 1956.
Addendum	3A(2): 742-744. 1956.
Marantaceae	1(3): 741-767. 1936.
Marcgraviaceae	3A(2): 703-717. 1956.
Martyniaceae (Gentry)	_____
Mayacaceae	1(3): 487. 1936.
Melastomataceae	4(1): 249-521. 1941.
Meliaceae	3(2): 717-777. 1949.
Menispermaceae	2(3): 680-699. 1938.
Monimiaceae	2(3): 784-819. 1938.
Moraceae	2(2): 274-331. 1937.
Supplement	2(3): 1126-1127. 1938.
Musaceae	1(3): 717-726. 1936.
Myricaceae	2(2): 261-263. 1937.
Myristicaceae (A. C. Smith)	2(3): 766-784. 1938.
Myrsinaceae	5(1): 163-203. 1959.
Myrtaceae (McVaugh)	4(2): 567-818. 1958.
(Najadaceae)	1(1): 89. 1936.
Nolanaceae	5(2): 829-854. 1960.
Nyctaginaceae (Standley)	2(2): 518-546. 1937.
Nymphaeaceae (Standley)	2(2): 638-639. 1937.
Ochnaceae	3A(2): 686-697. 1956.
Olcaceae (Standley)	2(2): 421-427. 1937.
Supplement	2(3): 1127-1132. 1938.
Oleaceae	5(1): 235-239. 1959.

Family	Publication Data
Onagraceae	4(1): 521-566. 1941.
Opiliaceae (Standley)	2(2): 420-421. 1937.
Orchidaceae (Schweinfurth)	30(1): 1-260. 1958.
	30(2): 261-531. 1959.
	30(3): 533-786. 1960.
	30(4): 787-1005. 1961.
Supplement	33: 1-80. 1970.
Orobanchaceae	5C(1): 103-104. 1961.
Oxalidaceae	3(2): 544-608. 1949.
Palmae	1(2): 321-418. 1960.
Papaveraceae	2(3): 933-936. 1938.
Passifloraceae (Killip)	4(1): 90-132. 1941.
Pedaliaceae (Gentry)	_____
Phytolaccaceae	2(2): 546-558. 1937.
Piperaceae (Trelease)	2(1): 3-253. 1936.
Plantaginaceae (Pilger)	6(2): 265-281. 1937.
Plumbaginaceae	5(1): 203-205. 1959.
Podocarpaceae	(as Taxaceae)
Podostemaceae	2(3): 1007. 1938.
Polemoniaceae (Gibson)	5A(2): 112-131. 1967.
Polygalaceae (<i>Monnina</i> by Ferreya)	3(3): 891-950. 1950.
Polygonaceae (Standley) (<i>Rumex</i> by Rechinger)	2(2): 444-468. 1937.
Pontederiaceae	1(3): 608-609. 1936.
Portulacaceae	2(2): 562-573. 1937.
Potamogetonaceae	1(1): 87-89. 1936.
Primulaceae	5(1): 149-152. 1959.
Proteaceae	2(2): 367-375. 1937.
Quiinaceae	3A(2): 717-726. 1956.
Rafflesiaceae	2(2): 443-444. 1937.
Ranunculaceae	2(2): 639-661. 1937.
Rapateaceae	1(3): 494-495. 1936.
Rhamnaceae	3A(2): 391-408. 1956.
Rhizophoraceae	4(1): 219-221. 1941.
Rosaceae	2(3): 1063-1119. 1938.
Rubiaceae (Standley)	6(1): 3-261. 1936.
Rutaceae	3(2): 655-689. 1949.
Sabiaceae (Gentry)	_____
Salicaceae	2(2): 260-261. 1937.
Santalaceae	2(2): 416-420. 1937.

Family	Publication Data
Sapindaceae	3A(2): 291-391. 1956.
Sapotaceae (Baehni & Bernardi)	5A(3): 135-177. 1970.
Saxifragaceae	2(3): 1015-1038. 1938.
Scheuchzeriaceae	1(1): 90-91. 1936.
Scrophulariaceae (Edwin)	5B(3): 459-717. 1971.
Simaroubaceae	3(2): 689-703. 1949.
Solanaceae (excluding <i>Solanum</i>)	5B(1): 3-267. 1962.
<i>Solanum</i> (Correll)	5B(2): 271-458. 1967.
Staphyleaceae	3A(1): 233-235. 1951.
Sterculiaceae	3A(2): 622-667. 1956.
Styracaceae	5(1): 225-235. 1959.
Symplocaceae	5(1): 214-225. 1959.
(Taccaceae)	1(3): 690. 1936.
Taxaceae	1(1): 82-84. 1936.
Theaceae	3A(2): 726-741. 1956.
Theophrastaceae	5(1): 153-163. 1959.
(Thurniaceae)	1(3): 494. 1936.
Thymelaeaceae	4(1): 203-206. 1941.
Tiliaceae	3A(2): 413-442. 1956.
Tovariaceae	2(3): 1006-1007. 1938.
Trigoniaceae	3(3): 950-954. 1950.
Triuridaceae	1(1): 96. 1936.
Tropaeolaceae	3(2): 608-620. 1949.
Turneraceae	4(1): 82-85. 1941.
Typhaceae	1(1): 87. 1936.
Ulmaceae	2(2): 268-274. 1937.
Umbelliferae (Mathias & Constance)	5A(1): 1-97. 1962.
Urticaceae (Killip)	2(2): 331-367. 1937.
Valerianaceae (Killip)	6(2): 287-321. 1937.
Velloziaceae (Gentry)	_____
Verbenaceae	5(2): 609-721. 1960.
Violaceae (Baehni & Weibel)	4(1): 56-82. 1941.
Vitaceae	3A(2): 408-413. 1956.
Vochysiaceae	3(3): 872-891. 1950.
Winteraceae	2(3): 699-700. 1938.
Xyridaceae	1(3): 487-489. 1936.
Zingiberaceae	1(3): 726-738. 1936.
Zygophyllaceae	3(2): 647-654. 1949.